Rebuttal of Miskolczi's alternative greenhouse theory

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Miskolczi (2010) theorizes that atmospheric CO_2 increases cannot lead to an enhanced greenhouse effect and therefore cannot be a cause of global warming. We show his theory to be incorrect both in its application of radiation theory and from direct atmospheric observations.

Introduction

Miskolczi (2007 and 2010) uses complex radiative transfer calculations on 228 measured atmospheric profiles of temperature and greenhouse gases to theorize 'physical rules' for the Earth's energy balance. He deduces a 'radiative exchange equilibrium law', stating that on average the downward thermal infrared flux at the Earth's surface (*Ed*) and the absorbed infrared radiation within the atmosphere (*Aa*) are equal. Miskolczi, shows that his law implies that the Earth's atmosphere should have a constant infrared optical thickness. Therefore, when carbon dioxide concentrations increase, other greenhouse gases should decrease to compensate. He then performs additional radiative calculations to suggest that observations since 1950 show that this is happening.

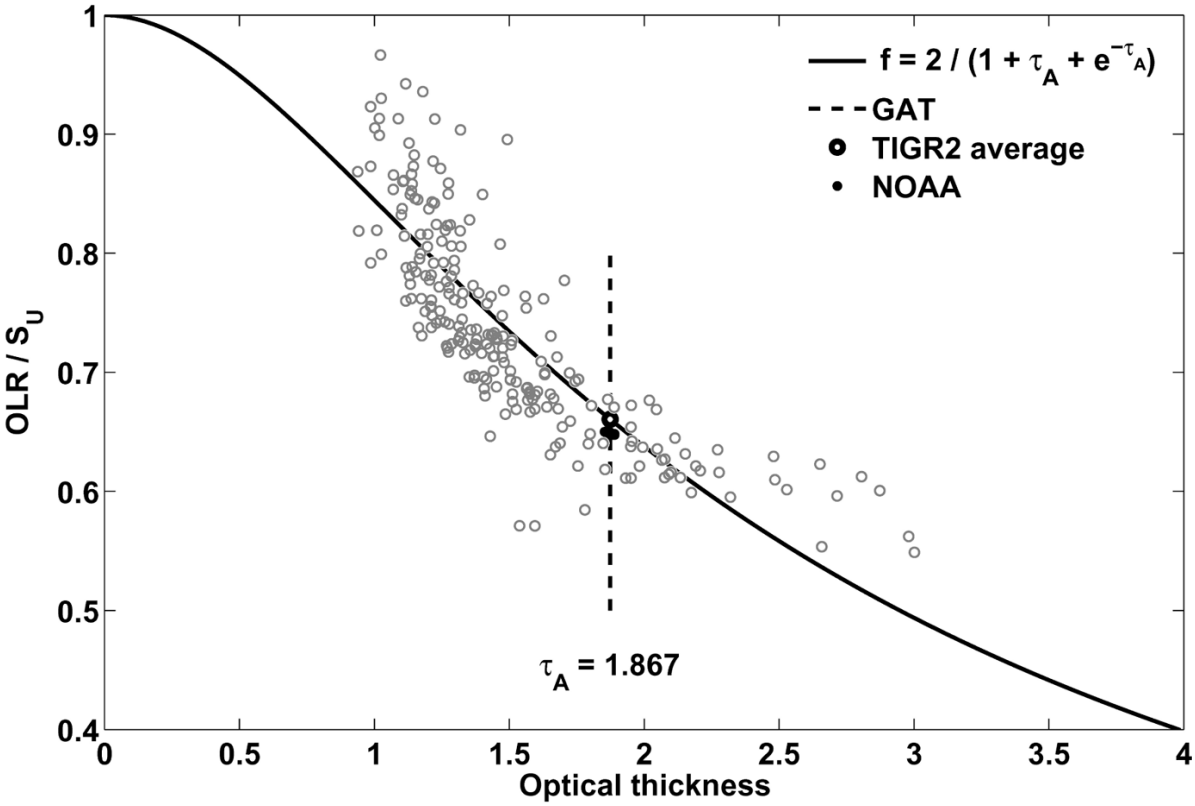
We firstly indentify problems with Miskolczi's theory and calculations and then show that in fact observations do not support his theory. It should be emphasized that we do not criticize radiative transfer models since they are based on fundamental well understood physics and have been applied in many fields of science, e.g. astronomy. Similar calculations have been routinely performed in atmospheric physics and climate studies using radiative models of similar complexity and these agree very well with observations.

Problems with Miskolczi's theory

Miskolczi (2010) proposes a 'radiative exchange equilibrium law', stating that on average the downward thermal infrared flux at the Earth's surface (*Ed*) and the absorbed infrared radiation with the atmosphere (*Aa*) are equal. By claiming that this approximate equality is a physical law Miskolczi is putting an additional unphysical constraint on atmospheric radiative transfer. In reality this approximate equality is caused by the fact that the upward surface flux is absorbed in the lower atmosphere and the downward infrared flux (*Ed*) also originates from this same region. This is due to the fact that the mass of most greenhouse gases is concentrated at lower levels and the temperature of these levels do not deviate much from the surface temperature. In this sense, Miskolczi did not find anything new. In fact, Miskolski overstates the equality of these two terms. Kiehl and Trenberth (1997) and Van Dorland (1999) find differences of 25 Wm^{-2} (over 5%) if clouds are accounted; Van Dorland (1999) additionally shows that clouds (globally averaged) increase both terms, *Aa* and *Ed*, almost equally. Therefore, the difference between Aa and Ed in the aforementioned cloudy case also applies to the clear sky case of Miskolczi.

The theory of Miskolczi is at odds with analyses of observations, including his own.

As a next step using his quasi radiative equilibrium model, Miskolczi calculates the relationship between outgoing longwave radiation (*OLR*) and the infrared flux originating from the Earths surface (*Su*). The relationship is a function of infrared optical depth (τ_A) only. The results are plotted in Miskolczi's Figure 7. As can be seen from that plot that there are significant deviations from Miskolczi's best fit. Converted into *OLR* difference we may calculate maximum differences of more than 40 Wm^{-2} (20%). Therefore, his optical depth function is not a robust finding.



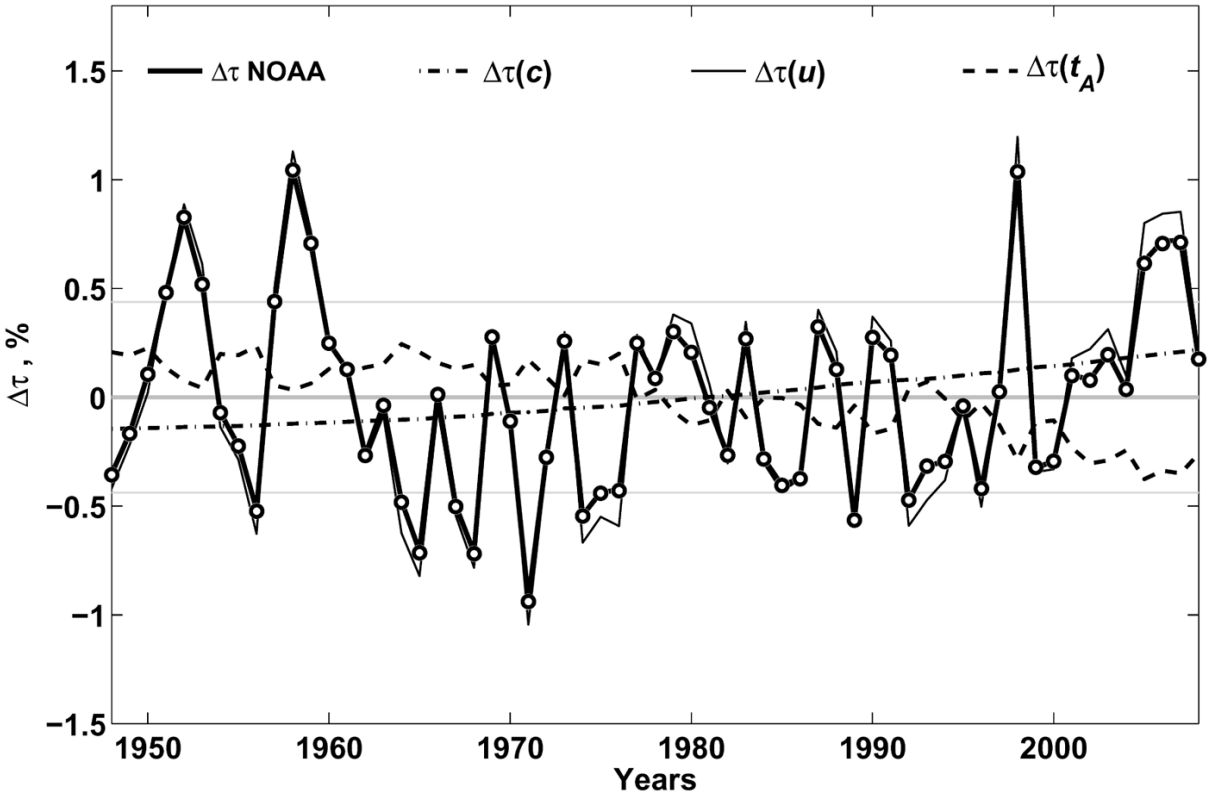
*Miskolczi, 2010, Figure 7***:** *The gray open circles are the 228 TIGR2 ascent data (profiles), and the 61 black dots, not visibly resolved in this diagram because they are so nearly coincident, are the NOAA annual averages. The black open circle is the average of the 228 ascent data and dashed line is the optical thickness in the global average temperature profile (GAT).*

From Miskolczi's Figure 7 it can be concluded that the *OLR* is dependent on the infrared surface flux (*Su*) and infrared optical depth (τ_A). This supports greenhouse theory. However, Miskolczi concludes that the optical depth in his global average temperature profile, τ_A = 1.867, must be constant value by stating "That the three global average optical thicknesses lie close to 1.87 is an indication that the global average atmosphere has a preference in setting its infrared optical properties". It's an average in his Figure, but no clear physical reason is stated why should it be fixed and nothing in his observations suggests it should be.

The consequence of setting a constraint on optical depth is that if the carbon dioxide concentration increases, other greenhouse gases must decrease. Miskolczi (2010) claims that the amount of water vapour is declining in time supporting his theory. He used NOAA

NCEP/NCAR reanalysis (2008) results to suggest this (see Miskolczi's Figure 11). NCEP/NCAR reanalysis is known to have poor long-term trends. What Miskolczi analysis actually shows is that water vapour fluctuations are dominantly responsible for the changes in optical depth, which is a reasonable finding. More importantly, his Figure 11 is a good illustration of the fact that the optical depth is not constant, and is therefore inconsistent with his own theory.

A more robust analysis of water vapour changes by Mears et al. (2010) shows that total column water vapour is increasing over the oceans in the period 1988-2009 at a rate of 0.27 +/- 0.08 mm/decade. This corresponds to about 1.2%/decade (IPCC, 2007). Although observations of trends in relative humidity are uncertain, they suggest that it has remained about the same overall, from the surface throughout the troposphere, and hence increased temperatures will have resulted in increased water vapour. Over the 20th century, based on changes in sea surface temperatures, it is estimated that atmospheric water vapour increased by about 5% in the atmosphere over the oceans (IPCC, 2007).



Miskolczi, 2010, Figure 11: *Summary of the perturbation study with the NOAA annual mean time series data. Here the normalized variability is plotted for the CO_2, H_2O and temperature perturbations. The reference value (61 year mean) of is 1.868754. The open circles indicate the sum of the Δ τ(c), Δ τ(u), and Δ τ(t_A) curves [Eds: the computed changes in infrared optical depth due to carbon dioxide, water vapour and temperature, respectively]. The thick black Δ τ curve is the unperturbed anomaly in the original . Obviously, the fluctuations of global average Δt are very largely explained immediately and directly by variations in water vapor column amounts.*

Finally, direct observations of *OLR* support an increasing greenhouse effect. For example, Chen et al. (2007) analysed satellite observations of the clear sky infrared emitted radiation by the Earth from between 1970 to 2006 and showed changes in the outgoing spectrum, which agreed with those expected from known changes in the concentrations of greenhouse

gases over this period of 36 years. Changing spectral signatures in CH_4, CO_2, and H_2O were observed, with the difference signal in the CO_2 matching well between observations and modelled spectra. Thus, the greenhouse forcing of the Earth has been directly observed to increase in response to greenhouse gas concentration increases, counter to Miskolczi's theory.

Conclusion

The alternative greenhouse theory of Miskolczi (2007,2010) results in a constant infrared optical depth with time, meaning that there can be no increasing greenhouse effect with time. Miskolczi suggests that observations show this ratio to be fixed. However, both observations and calculations with physically sound radiative transfer models show that Miskolczi's theory does not stand up to scrutiny. Moreover, there is ample observational evidence that the most important greenhouse gases, water vapour and carbon dioxide have increased in the last four decades, meaning that the total infrared optical depth is indeed increasing. Finally, direct satellite observations of the outgoing infrared spectrum show that the greenhouse effect has been enhanced over this period. Even the calculations of Miskolczi show a change of optical depth with time. Therefore, neither observations nor radiative transfer theory can support Miskolczi;s conclusions.

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